2023

M.Sc.

4th Semester Examination

ELECTRONICS

PAPER : ELC-404

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks.
Candidates are required to give their answers
in their own words as far as practicable.

Illustrate the answers wherever necessary.

Answer **all** questions.

(OPTICAL COMMUNICATION AND INFORMATION PROCESSING)

1. Answer *any* **four** questions from the following :
   2×4=8

   (a) Define numerical aperture of an optical fiber. Explain its significance.   1+1=2

   (b) What do you mean by intrinsic losses in optical fiber communication?   2

(c) What are the drawbacks of homo-junction semiconductor lasers? 2

(d) What is stimulated emission? In what ways, it is different from spontaneous emission? 1+1=2

(e) What are the different misalignment losses in optical fiber communication system? 2

(f) What is the application of multimode graded index fiber? 2

2. Answer *any* **four** questions from the following : 4×4=16

(a) Derive an expression for second order perturbation in energy when time independent perturbation is in action. 4

(b) What is WDM? What are the advantages of WDM over TDM? 2+2=4

(c) Consider a bare fiber consisting of a core of refractive index (n_1) 1·48 and having air $(n_2 = 1)$ as cladding. What is its numerical aperture? What is the maximum incident angle up to which light can be guided by the fiber? 2+2=4

(Continued)

(d) What is Bit Error Rate (BER)? Explain its significance with proper example.   2+2=4

(e) Using time-dependent perturbation theory, explain the phenomenon of absorption and emission.   4

(f) Discuss the working principle of LED with energy band diagram. What is internal quantum efficiency of an LED?   3+1=4

3. Answer *any* **two** questions from the following :   8×2=16

(a) *(i)* Derive the expression for non-linear coefficient n_2 in an optical fiber.

   (ii) What is Self Phase Modulation (SPM)?

   (iii) Mention the basic difference between Group Velocity Dispersion (GVD) and Self Phase Modulation (SPM).

   5+2+1=8

(b) *(i)* Explain the basic mechanism of optical amplification in an erbium-doped fiber amplifier.

   (ii) Discuss the functioning of electronic repeaters in long haul fiber optic *communication* systems.   5+3=8

(c) (i) Explain the Non-Return to Zero (NRZ) and Return to Zero (RZ) formats for two level binary line coding used for optical fiber transmission links.

(ii) Explain the basic structure of Synchronous Optical Network (SONET) frame. 5+3=8

(d) A step-index multi-mode fiber with a numerical aperture of 0.20 supports approximately 1000 modes at an 850 mm wavelength.

(i) What is the diameter of its core?

(ii) How many modes does the fiber support at 1320 nm?

(iii) How many modes does the fiber support at 1550 nm? 3+3+2=8

[Internal Assessment : 10 Marks]

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